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(54) Title: SHOE PRESS AND METHOD FOR SUPPORTING A PRESS SHOE IN A SHOE PRESS					
(57) Abstract					
<p>A method of supporting a press shoe in a shoe press for a paper or board machine, said press shoe (2) forming together with a counter roll (12) an extended nip (N) for a paper or cardboard web (W) and for a flexible circulated belt (12). On the outside of the loading cylinder (3, 4) of the press shoe there is arranged a compartment (15), to which hydraulic fluid is supplied in such a manner that the hydraulic fluid in the compartment directly or indirectly exerts a force upon the press shoe in the direction opposite to that of the force exerted upon the press shoe by the loading cylinder. The cylinder part (4) of the loading cylinder is movably arranged on the piston part (3). Said forces are dimensioned such that in operation they create a gap (16) between the press shoe and the loading cylinder, or between the supporting beam (9) of the press shoe and the loading cylinder, thereby allowing hydraulic fluid to flow out of the compartment (15). In an embodiment of a shoe press as described above, the working chamber (5) of the loading cylinder (3, 4) can communicate with the compartment (15) via a throttle (14). Alternatively, the working chamber and the compartment can be supplied with hydraulic fluid independently of each other.</p>					

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SHOE PRESS AND METHOD FOR SUPPORTING A PRESS SHOE IN A
SHOE PRESS

The invention relates on the one hand to a method of supporting a press shoe in a shoe press and, on the other hand, to a shoe press.

The invention concerns a shoe press for a paper or board machine, said shoe press having a press shoe which together with a counter roll forms an extended nip for a paper or cardboard web and for a flexible circulated belt, and at least one piston-and-cylinder assembly, which is arranged between a supporting beam associated with the frame system of the shoe press and the press shoe and in which hydraulic fluid is supplied to a working chamber, said working chamber communicating with a compartment via a throttle, said compartment being arranged on the outside of the piston-and-cylinder assembly in such a manner that the hydraulic fluid therein exerts directly or indirectly a force upon the press shoe in the direction opposite to that of the force exerted upon the press shoe by the hydraulic fluid in said working chamber.

A shoe press as described above is disclosed in DE-C1-195 15 832, the piston in the piston-and-cylinder assembly having said compartment.

This prior-art shoe press suffers from the drawback that lateral forces which in operation affect the press shoe are transmitted to the cylinder jacket and the piston, which may cause a jam between the press shoe and the piston.

The object of the invention is to eliminate this drawback.

According to one aspect of the invention, the drawback implying that lateral forces which in operation affect a press shoe are transmitted to the cylinder jacket and the piston has been eliminated by a new method

of supporting the press shoe, said method having the characteristic features as defined in claim 1. Advantageous embodiments are stated in the subclaims.

Moreover, the object has been achieved by means of 5 a shoe press having the characteristic features as defined in claim 4. Preferred embodiments are stated in the subclaims.

Three embodiments of the invention will now be described in more detail with reference to the accompanying 10 drawings, in which

Fig. 1 is a cross-sectional view of a first embodiment of the shoe press according to the invention,

Fig. 2 is a cross-sectional view of a second embodiment of the shoe press according to the invention, and

15 Fig. 3 is a cross-sectional view of a third embodiment of the shoe press according to the invention.

The cross-sectional views are taken transversely of the machine direction of the paper machine, and it is understood in this specification and in the claims that 20 the press shoe is a single piece while there is at least one, preferably more piston-and-cylinder assemblies and several compartments distributed in the longitudinal direction of the press shoe (cross-direction of the paper machine).

25 In Figs 1 and 2, reference numeral 1 designates two embodiments of a shoe press and reference numerals 2, 3, 4 designate a press shoe, a piston and a cylinder, respectively. The cylinder 4 and the piston 3 which is movingly arranged therein define a chamber 5, to which a 30 hydraulic fluid, e.g. oil, is supplied from a duct 6 in the piston 3 via one or more bores 7 in the piston 3. A radial seal 8 is arranged for the sealing of the chamber 5. The piston 3 is slightly tilttable in the cylinder 4.

Reference numeral 9 designates a horizontal supporting 35 beam located in the shoe press and fixed to the frame. In the embodiment according to Fig. 1, the piston 3 is fixedly connected to the press shoe 2, and the end

wall of the cylinder 4 rests freely on the beam 9, while in the embodiment according to Fig. 2, the piston 3 is fixedly connected to the beam 9 and the press shoe 2 rests freely on the end wall of the cylinder 4. For said 5 connection, use is made of bolts 10. The flexible press belt of the shoe press is designated 11, and the counter roll of the shoe press is designated 12.

In operation with the working chamber 5 pressurized, a paper web W and the circulated press belt 11 guided by 10 the shoe press 1 pass through the nip N between the press shoe 2 and the counter roll 12, the felt F receiving water from the paper web W.

In the end wall of the cylinder 4 there is arranged a through throttle 14 which opens into a shallow compartment or pressure chamber 15 in the end wall of the cylinder 4. Hydraulic fluid in the chamber 5 may thus escape to this compartment via the throttle 14. The area of the compartment 15 is somewhat larger than the inner area of the cylinder 4, which causes the lifting force exerted 15 upon the press shoe 2 by the hydraulic fluid in the compartment 15 at an initial stage of the operation to be greater than the force exerted upon the press shoe 2 by the hydraulic fluid in the working chamber 5. This results in the forming of a gap 16 between the annular 20 bottom surface 4' of the cylinder 4 and the beam 9 (Fig. 1) and between the annular top surface 4' of the cylinder 4 and the press shoe 2 (Fig. 2), respectively, through which gap 16 hydraulic fluid constantly flows out of the compartment 15, such that the press shoe 2 floats 25 freely. In operation, there is thus a supporting and lubricating hydraulic fluid film in the gap 16, which can be said to define a hydrostatic bearing between the upper side of the beam 9 and the annular surface 4' in Fig. 1 and between the underside of the press shoe 2 and the 30 annular surface 4' in Fig. 2. A person skilled in the art 35 will, without inventive effort, adapt the diameter of the

throttle 14 and the area of the compartment 15 to each other, thereby obtaining a suitable film thickness.

Fig. 3 illustrates a shoe press having a press shoe 300, a counter roll 312, a circulated press belt 311, a piston-and-cylinder assembly 310 with piston 330 and cylinder 340, and a beam 309 which is fixed to the frame. The piston 330 is attached to the beam 309 by means of bolts 350. The top face of the movable cylinder 340 adjoins the press shoe 300, and in this top face there is a compartment or hydraulic fluid chamber 301, which is defined by an annular flange with an annular surface 340' on the top of the cylinder 340. The compartment 301 is supplied with hydraulic fluid via a sectional pipe 303 which is attached to the longitudinal side edge 304 of the press shoe 300 and which has an inner duct 306, via a bore 302 formed in the press shoe 300 and having bore portions 302' and 302" which are perpendicular to each other, and an opening 308 which is formed in the sectional pipe 303 and constitutes a throttle. For the attachment of the sectional pipe 303 use is made of screws 305 and threaded bores 305' in the press shoe. The working chamber 325 of the piston-and-cylinder assembly 310 is supplied with hydraulic fluid, like in the embodiments above, via a duct system 326, 327 in the piston 330. The difference over the embodiments above thus is that there is no connection between the compartment 301 and the working chamber 325, but the compartment 301 and the working chamber 325 are separately supplied with hydraulic fluid via the ducts 326 and 327 in the piston 330. This arrangement makes it possible to form a gap 336 between the underside of the press shoe 300 and the annular top face 340' of the cylinder 340, through which gap hydraulic fluid can flow out of the compartment 301 while forming a hydrostatic bearing, even if, as illustrated, the surface area of the compartment 301 is smaller than the inner area of the cylinder 340. An O-ring seal

between the cylinder 340 and the piston 330 is designated 380.

It will be appreciated that the object of the invention has thus been achieved, and moreover that the sealing of the above-mentioned prior-art press piston against the press shoe is unnecessary in the inventive shoe press.

The inventive shoe press is applicable also to calendering operations in a paper or board machine.

CLAIMS

1. A method of supporting a press shoe in a shoe
5 press for a paper or board machine, said press shoe (2; 300) forming together with a counter roll (12; 312) an extended nip (N) for a paper or cardboard web (W) and for a flexible circulated belt (12; 311), and at least one piston-and-cylinder assembly (3, 4; 330, 340), which is
10 arranged between a supporting beam (9; 309) associated with the frame system of the shoe press and the shoe press and in which hydraulic fluid is supplied to a working chamber (5; 325), a compartment (15; 301) to which hydraulic fluid is also supplied being arranged on
15 the outside of the piston-and-cylinder assembly in such a manner that the hydraulic fluid therein exerts directly or indirectly a force upon the press shoe in the direction opposite to that of the force exerted upon the press shoe by the hydraulic fluid in said working chamber,
20 characterized in that the cylinder (4; 340) in the piston-and-cylinder assembly is movably arranged on the piston (3; 330) of the piston-and-cylinder assembly, and that said forces are dimensioned such that in operation they create a gap (16; 336) between the press shoe
25 and the piston-and-cylinder assembly, or between the supporting beam and the piston-and-cylinder assembly, thereby allowing hydraulic fluid to flow out of the compartment (15; 301).
2. A method as claimed in claim 1, characterized in that hydraulic fluid is supplied to the compartment (15; 301) via a connection (14) between the working chamber (5; 325) and the compartment.
3. A method as claimed in claim 1, characterized in that the compartment (15; 301) and the working chamber (5; 325) are supplied with hydraulic fluid independently of each other.

4. A shoe press for a paper machine, said shoe press having a press shoe (2) which together with a counter roll (13) forms an extended nip (N) for a paper or board web and for a flexible circulated belt (12), and which

5 press shoe is pressed against the counter roll (13) by means of at least one piston-and-cylinder assembly (3, 4), which is arranged between a horizontal supporting beam (9) associated with the frame system of the shoe press and the press shoe (2) and in which hydraulic fluid

10 is supplied to a working chamber (5), the working chamber (5) communicating with a compartment (15) via a throttle (14), said compartment (15) being arranged on the outside of the piston-and-cylinder assembly (3, 4) in such a manner that the hydraulic fluid therein exerts directly or

15 indirectly upon the press shoe (2) a force which is opposed to the force exerted upon the press shoe (2) by the hydraulic fluid in said working chamber (5), characterized in that the working chamber (5), the compartment (15) and the throttle (14) are so designed and dimensioned as to create a hydrostatic bearing

20 between the piston-and-cylinder assembly and the press shoe.

5. A shoe press as claimed in claim 4, characterized in that the compartment (15) is arranged in the cylinder (4) of the piston-and-cylinder assembly.

6. A shoe press as claimed in claim 4 or 5, characterized in that the compartment (15) is open towards the press shoe (2), the piston (3) of the

30 piston-and-cylinder assembly being fixedly connected to the supporting beam (9).

7. A shoe press as claimed in claim 4 or 5, characterized in that the compartment (15) is open towards the supporting beam (9), the piston (3) of the

35 piston-and-cylinder assembly being fixedly connected to the press shoe (2).

8. A shoe press as claimed in any one of claims 4-7, characterized in that the area of the compartment (15) is larger than the area of the working chamber (5).

5 9. A shoe press for a paper machine, said shoe press having a press shoe (300) which together with a counter roll (312) forms an extended nip (N) for a paper or cardboard web (W) and for a circulated flexible belt (311), and which is pressed against the counter roll (312) by
10 means of at least one piston-and-cylinder assembly (310), which is arranged between a horizontal supporting beam (309) associated with the frame system of the shoe press and the press shoe (300) and in which hydraulic fluid is supplied to a working chamber (325), hydraulic fluid
15 being also supplied to a compartment (301), which is arranged on the outside of the piston-and-cylinder assembly (310) in such a manner that the hydraulic fluid therein exerts directly or individually upon the press shoe (300) a force which is opposed to the force exerted
20 upon the press shoe (300) by the hydraulic fluid in said working chamber (325), characterized in that the working chamber (325) is supplied with hydraulic fluid via ducts (326, 327) arranged in the piston (330), while the compartment (301) is supplied with hydraulic
25 fluid via a duct (302) formed in the press shoe.

10. A shoe press as claimed in claim 9, characterized in that the duct (302) in the press shoe is supplied with hydraulic fluid via a pipe (303) which is releasably attached to the press shoe and the
30 bore (306) of which communicates with the duct (302) via a hole (308) formed in the pipe wall.

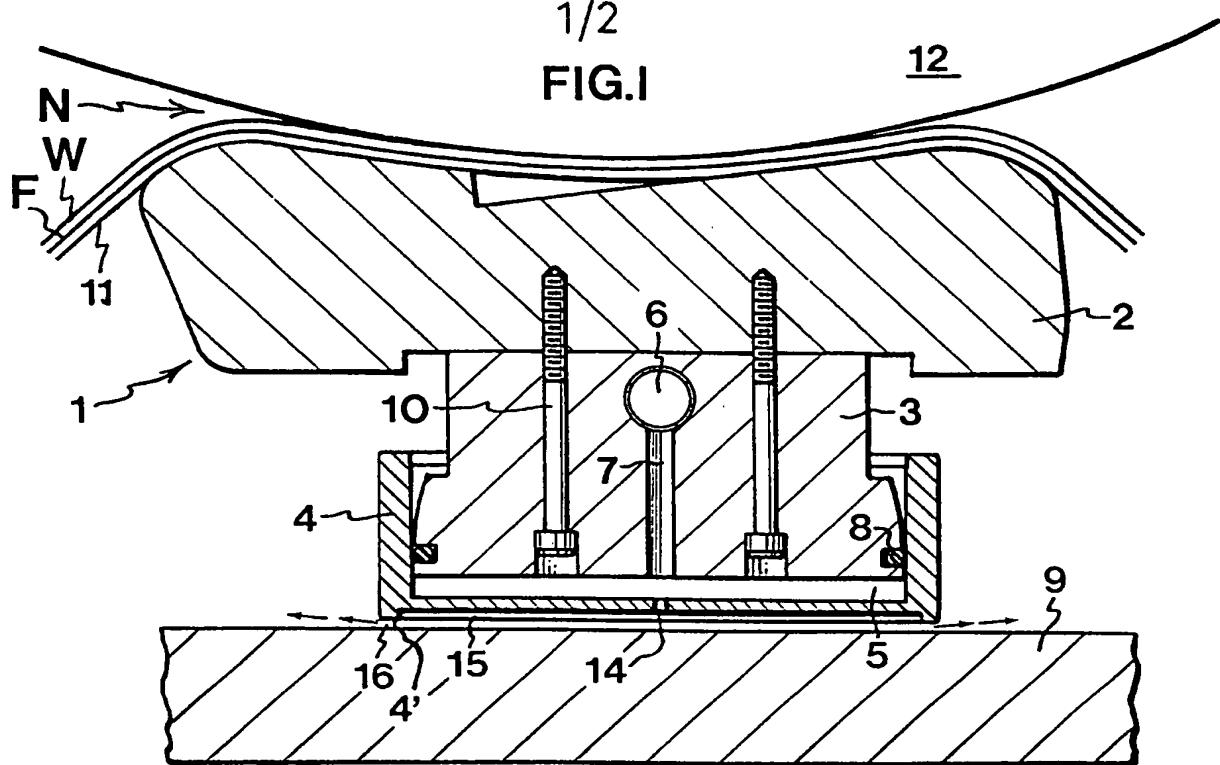
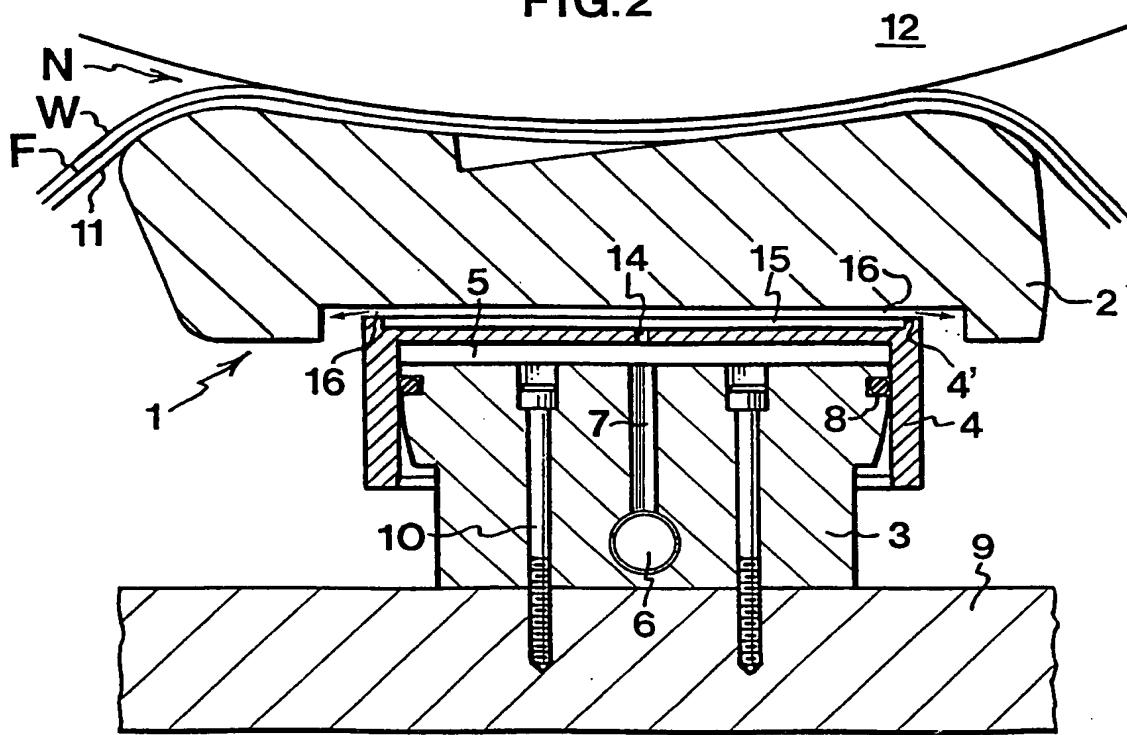
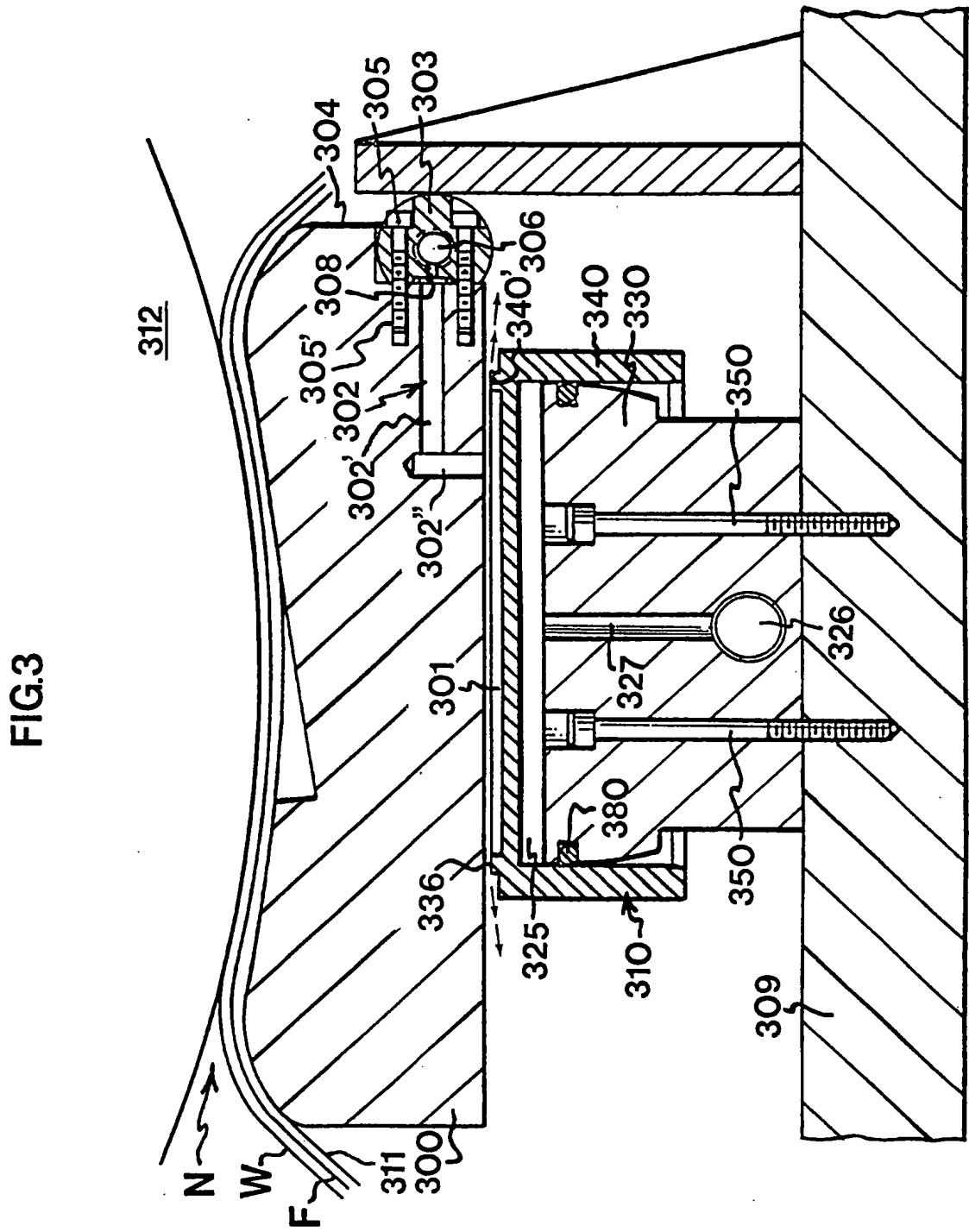
1/2
FIG.1

FIG.2



2/2



1
INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 98/01758

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: D21F 3/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: D21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 19515832 C1 (VOITH SULZER PAPIERMASCHINEN GMBH), 2 May 1996 (02.05.96) -- -----	1,4,9

Further documents are listed in the continuation of Box C. See patent family annex.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

01/12/98

International application No.
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